

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of)
)
TECHNOLOGICAL ADVISORY COUNCIL (TAC)) ET Docket No. 16-191
Noise Floor Technical Inquiry)

To: The Commission

Comments

Larry H. Will, PE, a Licensed Professional Engineer in Pennsylvania and New Jersey (“LHW”), hereby submits these Comments in the above-captioned proceeding to gather information on the extent of RF noise increases over the last 20 years. In support thereof, LHW submits the following:

LHW has over 50 years experience in radio and television broadcasting including AM radio station partner ownership and holding various Chief Engineer and Director of Engineering experience positions in AM, FM, and TV facilities; as well as civilian and military strategic and tactical point to point, microwave, and satellite communications systems. His qualifications are a matter of record with the Federal Communications Commission.

As a result of his experience, LHW is directly interested in the proposals the Commission has set forth in the Noise Floor Technical Inquiry, ET 16-191. He welcomes the Commission's consideration of ways in which to improve various radio services to the public. In my career in

RF communications, I have personally spent many hours on many projects involving not only RF noise issues but also RF interference issues. RF noise issues, by far, are the most widespread and in urgent need for improvement.

I will present a few of these cases here to demonstrate that there has been a significant increase in background noise levels from the VLF thru UHF frequencies over the last 50 years let alone 20 years.

THE LF AND MF BANDS

First I'll address the VLF thru MF bands. I have a reasonably well equipped shielded loop receiving system at my home for the 10 to 600 KHz range. This system is used for casual listening to interesting services in that range to include VLF NDB (Non-directional Beacons) in the 190 to 535 kHz range as well as for new experimental stations operating in the 600 meter band or 472-479 KHz range. My location is a suburban area with nearby utility lines underground¹ which should result in low radiated noise levels at VLF-MF range and indeed it does at least away from structures.

However, after I completed this installation, one evening I noticed horrific noise levels on the LF band receiver. The culprit was easily found, it was a single LED "Coach light" that was located on my detached garage. Turning off that 27 LED 4 watt light completely eliminated the noise. In this case the receive loop was approximately 75 feet from the antenna and is designed

¹ The nearest overhead power distribution lines are at least 0.4 miles away. The wiring from my antennas is buried from the base of the structure(s) to the point of entry into the house.

as a shielded magnetic antenna. The distance suggests it was a radiated signal from the wiring in the garage, which, by the way, is all in metallic fully grounded flexible metal conduit. Prior to turning off that LED, a check with an MF Broadcast receiver showed that the noise was still present but diminished with an increase in frequency.

AM BROADCAST RECEPTION IN VEHICLES

Since I was a teenager, I have spent a lot of time listening to radio while driving. I listen to AM and FM as well as satellite systems (SIRIUS-XM). No issues with XM because at the 2 GHz band, noise emitters signal levels are so weak that no perceptible interference currently is observed. A much different story is found at 530 to 1700 KHz and up into the HF band. Here I have found that the most significant noise radiation is coming from the high voltage medium power transmission system². To a lesser extent, it also is from the It is bad in urban areas, suburban areas, and to a lesser extent, with one exception discussed below, rural areas. Over the last 50 years, utilities everywhere have gradually raised the distribution system voltages from 2300 volts to as high as 13,200 volts. Worse 33 kV and 66 kV transmission system lines now often are located directly above the 13,200V distribution lines. My training and experience with this type of noise is a mixture of conducted and radiated RF that can be associated with aging support poles and cross-arms particularly from wooden poles and supports which expand and contract with temperature resulting in loose nuts, washers, and bolts on metallic fasteners and the “working loose of nails” which often are used for ground leads. The close proximity HV lines

² My experience driving near and under the UHV (115,000 volts and up) distribution lines is that they rarely cause noise issues at more than 200 feet from those lines.

cause intense electric fields which can and do cause arcing in pole hardware³. This ARRL publication should be must reading for anyone not completely familiar with radiated and conducted radiofrequency noise.

In 1967, as a Communications-Electronics Officer in an Army Engineer Command, I was directly involved in South Vietnam with salt contamination on HV distribution lines of 4600 volts that coupled with the humid salty air resulting in high voltage corona easily audible and visible at night. While not a broadcast issue, the level of arcing caused severe deterioration of our nearby unit FM VHF communications systems in the 30 to 88 MHz bands. These affected systems impaired had fixed vertically polarized ground plane antennas mounted 20-40 feet above ground and located within 75 to 100 feet from the HV line system.

I have also observed this type of noise in the broadcast band down along the New Jersey Coast line. In addition, traveling in southern Florida, the radiated noise levels from what appear, by inspection, to be 66 KV lines can be of such intensity that driving along I-75 in the everglades, even with no electrical lines within view, makes vehicular AM reception for all but the most powerful stations impossible. This very high noise level is also a problem in the HF band for frequencies from 3 thru 28 MHz.

Listening to AM reception in suburban and urban areas, where known station RF levels are in the range of 2 to 5 mV, one can easily hear the changing background “noise” coming and going as one drives along. Below desired listening levels of 1mVm, the ever varying noise levels are quite noticeable especially with talk programming. Without a careful signal type

3 See ARRL Publication “*The ARRL RFI Book, 3rd Edition*”, 2010, Chapter 11.

determination of the many disturbances heard, it is difficult to quantify exactly what the actual noise is. Precision noise receivers or ultrasonic detectors are needed to identify and log suspect sources. Trained operators and reliable equipment will be needed for the job,

NOISE LEVELS WITHIN RESIDENCES AND COMMERCIAL BUILDINGS

For years I have been tracking down noise sources within my own home as well as homes of neighbors and friends, as they relate to both AM stations and amateur radio reception on the HF bands. One type of case I am familiar with from more than one location is a defective thermal cutout safety switch on a residence electrically operated doorbell. The doorbell transformers have a thermal cutout which may be triggered to operate if the transformer overheats. A shorted winding can and has caused these failures. As a result the low voltage wiring for the doorbell will radiate cyclic buzzing noises throughout MF and HF bands often up to 30 MHz or higher and into low band TV frequencies. The range of destructive interference can extend over 100 – 200 feet from the residence with the problem. The result usually will be pixilation with digital video signals and audible buzzing noise with aural signals. Even getting access to show the owner the problem sometimes can be difficult.

I have found many newer all solid state switching supply “wall warts” low voltage DC supplies that more than not are provided by the “cable company” or other video provider to power the digital “Set Top Box”. Simply obtaining an older “heavy” unit, i.e. a linear transformer powered unit” solves the problem. However the average consumer (1) doesn't read

the manual about interference, and (2) has no clue that a simple “wall wart” could cause such havoc.

I also have witnessed flat screen TV sets that utilized CFL back lighting and radiate enough noise that high band VHF channels cannot be received with an indoor antenna that is often placed directly behind the screen to it can be “out of site”. The owners had no idea. Its only near the set where the interference occurs but sometimes the self-contained lead wire from the antenna is too short to place the antenna at a location where stations can be received and the noise is diminished enough to eliminate the interference.

As for commercial buildings, the FCC Rules used to have a 25 mV/m limit for AM service the “industrial area of a community”. The intent was to provide enough signal to attempt to penetrate commercial buildings with AM signals. Even that was often not enough signal to allow reliable reception. Those requirements have long since been eliminated. The current unintentional radiator Rules allow for higher RFR levels of interference energy for unintentional radiators in commercial usage but many retailers sell noise generating lights and other electrical devices that are marked for “commercial use only” to residential customers in violation of Part 18.

FCC PARTS 15 AND 18 SHOULD BE HARMONIZED AND THE FREQUENCY RANGES EXPANDED AND INFORCED

As a minimum all types of devices covered by 47 CFR Parts 15 and 18 with respect to caused interference should require testing from below 500 kHz to well up into the 1 GHz range. This change should help in “future proofing” the Rules for the foreseeable future. The newer relaxed “source certification” particular with respect to off shore produced items should be eliminated. Rules should be changed as needed by Congress to increase penalties and support more materials inspection, otherwise more and more of these interferers will still be imported and installed.

SOME FIXTURES DO COMPLY

I recently purchased a 4 foot LED based shop light from a big box store for my workshop. I purchased it specifically to take some listening measurements to determine if this fixture would be acceptable or add to my noise issues. I used a Sony Model 2010 LF, MF, HF battery operated radio that utilizes a magnetic antenna from LF thru MF and a whip for HF reception. Very close to the fixture, the detected radiation noise received when the lamp was energized was significantly strongest at LF and low MF reception and was emanating from the end of the fixture that had the circuitry to power the LV LED light from the 120V mains. The fixture itself was a metallic design the provided shielding of the internal electronics assembly.

There was no conducted radiation on the unshielded power line however, and at approximately 6 feet from the fixture no increase in background noise was noticed when the new light was cycled on and off several times. This particular fixture appears to not be a problem with noise generation conduction or radiated.

ENFORCEMENT

I have to conclude that cleaning this up is a very expensive undertaking. The amount of non-conforming and illegally sold devices already installed has to be astronomical. The aging power infrastructure, if not addressed, will continue to be a continuing problem. Five miles from my home along a major 4 lane road in a suburban mixed business and residential area, there is an on going power line related noise that completely blocks mobile reception of a local Class A 50 kW station that has never been corrected in at least the last 10 plus years. Recently after road widening causing some utility poles to be replaced, the noise was gone for about 3 weeks. Its now back exactly as it was before the upgrades. I do not know if the local power company has ever been notified of the problem. It is a high rated station in the market and the noise is significant for about ½ mile along that road, long enough to cause some listeners to “tune out” and change stations.

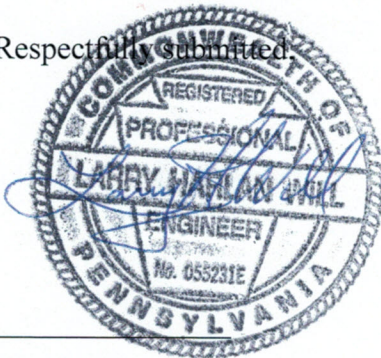
CONCLUSIONS

It will take money and people to turn around the already in place power line system caused noises, installed in home noise causing devices, and to establish forced inspections of off

shore devices imported into the country to stem the continuing flow of such items and start to reduce the background level on existing noise causing sources.

Based on my experience, I believe the most important issue to be addressed is unintentional radiators. While I have experienced cases of intentional radiators causing interference these were primarily caused to services such as public safety or aircraft which did not involve the general public. So power line noise and in home LED's, CFL's and small solid state power supplies and similar items appear to be the most important items for initial remediation steps.

Respectfully submitted,



Larry H. Will, PE.

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